A. a. strictocollaris: PANAMA. CANAL ZONE: Lion Hill (2); Tabernilla (2); Gatun (2). PANAMA PROVINCE: Utivé (1); Cerro Chucantí (3); Cerro Azul (1). COLON: Porto Bello (2). SAN BLAS: Mandinga (1); Armila (1). DARIEN: Río Jaqué (8); Tacarcuna Village (9); La Laguna (1); Cerro Pirre (1); Cana (2). COLOMBIA. CHOCO: Acandí (5).

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Notes on the extinct *Argusianus bipunctatus* (Wood)

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All published sources, including Peters (1934), Delacour (1951) and Warren (1966), cite incorrectly the type description of *Argusianus bipunctatus* (Wood).

The description accepted as the first by these writers was a letter written by T. W. Wood on 22 June 1871 (the author's manuscript date) and published presumably later than June (Wood 1871a). This letter gives an engraving of the type specimen, a description, and the proposed name *Argus bipunctatus* attached both to the illustration (which is on an earlier page) and to the description. However, this letter states that "a letter of mine appeared in the 'Field' newspaper of April 8th. ult . . .".

Reference to *The Field* for that date shows that Wood (1871b) had published the same engraving, with a nearly identical text, and proposed the name *bipunctatus*, approximately 3 months earlier than his June letter. Correct citation of the type description should therefore be:

Argus bipunctatus Wood, The Field, 8 April 1871, p. 281.

Subsequent mention of this species in publications has included no more details than were given by Wood himself. The type and only known

specimen is a portion of a male's primary from the right wing, broken off both distally and proximally. The length of surviving rachis is 250 mm, with both webs intact for 160 mm. Wood (1871a, b) noted that the rachis was extremely slender, and Delacour (1951) suggested that the feather was probably therefore long. The distal 170 mm of surviving rachis are less than 1 mm broad, and consequently highly flexible.

In the extant species *A. argus* the primaries have a very broad robust shaft with not more than the distal 70 mm narrower than 1 mm. The short flexible tip is pressed hard against the ground when the male displays his primaries and secondaries in a circular fan (Davison 1982). In this fan, the outer web of one primary overlaps part of the inner web of the next primary descendant. Thorn-shaped short friction barbules (Lucas & Stettenheim 1972) distinguish the area of overlap and maintain the integrity of the fan during display. On each primary the area of inner web exposed during display is densely spotted with chestnut and black, while the concealed area is sparsely spotted or unmarked. Only at the tips of the primaries, where they diverge and eliminate overlap, are the inner webs spotted throughout.

In the feather of *A. bipunctatus* the tip is missing, but the distribution of short friction barbules indicates that the end of the feather is being approached. Extrapolation from its shape suggests that the portion of shaft narrower than 1 mm may have exceeded 250 mm, on a feather of total length 600 mm from tip to skin insertion. Hence, assuming that in display this flexible tip was pressed against the ground, a much longer portion of each primary would have had its entire span exposed, without overlap by the adjacent feathers. This is confirmed by the feather's pattern, which shows chestnut and black spots densely packed over the full expanse of both webs.

In the living *A. argus,* flight by males is laboured, propulsive power coming from the robust-shafted primaries and the (mainly) aerofoil characteristics provided by the long floppy secondaries. Contrary to Wood, the surviving feather fragment of *A. bipunctatus* indicates a primary at least as broad as, and much longer than, those of *A. argus*. The great length of slender shaft, greater even than in the already limp secondaries of *A. argus,* implies a feather with poor aerodynamic properties. Poor flight characteristics are also suggested by the relative width of the outer web, which is 40% the width of the inner web in *A. argus,* but 60% the width (and consequently more flexible) in *A. bipunctatus*.

Based on the greater feather length, slender and flexible shaft, relative width of the inner and outer webs, and the greater specialization of the primary presumably for display in a contorted fan, I suggest that *A. bipunctatus* may have been flightless.

The origin of the feather fragment is unknown. Wood (1871a, b) found it amongst a bundle of feathers of *A. argus,* and one possibility is that these feathers had been marketed in the London plume trade. Only in 1891 was the specimen presented to the British Museum by Edward Bartlett (Warren 1966), and Bartlett's association from 1894 with the Sarawak Museum casts no light on the origin of the feather.

Delacour (1951) suggested *A. bipunctatus* might have lived on Java, presumably because Java is a large gap in the Sundaic range of *A. argus*. Javan ornithology, however, has a history beginning much earlier than the discovery date of *A. bipunctatus,* and such a bird is unlikely to have been

missed by Horsfield, Raffles and others (Horsfield 1824). Flightlessness, and isolation from *A. argus,* imply an island distribution; island forms are often larger than mainland relatives (MacArthur & Wilson 1967), and larger feather size could indicate larger body size. Extant *A. argus* are found on only one offshore island, Pangkor (4° 15′N, 100° 32′E), where 25 km² of habitat is sufficient for a self-sustaining population. It is absent from a larger island, Tioman (2° 48′N, 104° 11′E). Tioman has nearly 100 km² of forest habitat over steep, dry and rocky slopes of a type which on the mainland Malay Peninsula constitute favoured habitat for *A. argus* (Delacour 1951, Davison 1981). Tioman, which became isolated by rising sea levels 15,000–20,000 years ago, is probably suitable to support a population of Argus (Medway 1966a) and has few mammalian predators (Medway 1966b). It has a history of habitation by villagers dating back several centuries (Bullock & Medway 1966), but was not zoologically explored until 1899 (Miller 1900).

I suggest that changing Pleistocene sea levels in the Sunda subregion could have isolated an *Argusianus* population on Tioman, where suitable habitat and paucity of predators might have permitted the evolution of larger size and flightlessness, and the sparse forest understorey might have selected for larger males with larger wing fans used in display. The history of occupation of Tioman by man might explain the recent extinction of a large edible bird prior to scientific discovery of its distribution.

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